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EXPLANATION OF PLATE 324

FIG. 1. FRAXINUS NIGRA. Transverse section × 45, showing arrangement and distribution of vessels in early and late wood, narrow rays and terminal wood parenchyma.

FIG. 2. FRAXINUS NIGRA. Radial section × 100, showing margin of a growth ring, wood fibers, vessel segments, terminal pore in a late vessel, vasicentric and terminal wood parenchyma.

FIG. 3. FRAXINUS NIGRA. Tangential section × 100, showing vessel segments, wood fibers, vasicentric wood parenchyma, and distribution of rays in late wood.

FIG. 4. FRAXINUS NIGRA. Tangential section × 200, showing pitted vessel segments of early wood.

NOTES ON THE DESMID FLORA OF NEW ENGLAND I.

THE GENUS EUASTRUM IN MASSACHUSETTS[1]

GERALD W. PRESCOTT

Plate 325

THE genus *Euastrum* is a very interesting one for study, presenting as it does a number of taxonomic problems and a great variety of beautiful cells. The wall-markings in species of this genus, often very complex and elaborate, are helpful for identification purposes but to this end there is demanded critical discrimination on the part of the student. Because of the fact that these markings are easily obscured by density of cell-content, they are frequently overlooked. The failure to give sufficient attention to these often specific wall-characters leads to erroneous determinations, inadequate descriptions and, too

[1] Printed with aid to RHODORA from the National Academy of Sciences.

often, to incomplete and inaccurate figurings of these plants in literature. Hence, published figures, rather than being of assistance, are often misleading for purposes of identification, particularly to the beginning student. When an inaccurately executed published drawing is compared with the figure of the type or with a series of apparently faithful drawings the question naturally arises as to whether or not the worker had seen the form indicated or some other similar species.

It is the opinion of the author that one of the characteristics of the *Euastrum* cell has not received proper attention in both description of species and in drawings. This is the mucilage pore. The number and position of these pores are apparently specific and may be of assistance in making determinations. Too frequently the presence or absence of these pores is disregarded and, if present in the cell, are seldom shown in drawings.

It is the purpose of this paper to present certain notes and drawings for species of *Euastrum* in New England, which are new to the region or which, according to the writer's opinion, have been inadequately figured. Also plants are figured here which, so far as known, have never been illustrated in American literature, although they may have been reported and figured for this country in foreign journals.

The genus is well represented in New England habitats, there being some eighty species of a total of approximately one hundred forty varieties and species now known for North America. Our knowledge of the desmid flora of the region is largely the result of the works of Cushman (4–15), Harvey (17), (18), (19), Johnson (21), (22), W. and G. S. West (28–34), Hylander (20), and Wolle (35).

It is to be regretted that Cushman did not treat the genus *Euastrum* synoptically as he did some of the other desmid genera. The desmid literature is so very much scattered in this country (as in others, unfortunately) and the group so huge that the student of these plants must work under great handicaps. The possibility of having a monograph for this country similar to the work of the Wests in Great Britain is an achievement to be looked forward to. Such a monograph would of course be highly desirable because of the fact that the British Monograph is rapidly becoming insufficient, helpful and necessary as it is. It would seem that if such a work is ever to be accomplished in this country it must be done by contributions in the nature of generic monographs or synopses from various individuals. The lifetime of a single worker is scarcely long enough to permit the monographing of the entire group. Certainly Cushman made a start

in the direction of preparing synopses of the genera, at least for a restricted region.

The species dealt with in this paper are from collections made by the author on Cape Cod and adjacent islands during the summers of 1932 and 1933. From time to time it is hoped that he can add to knowledge of the algal flora for this very rich desmid region.

EUASTRUM Ehrenberg, 1832

EUASTRUM DIDELTA (Turp.) Ralfs. West and West, British Desmidiaceae II: 15, Pl. 35, f. 3–7.—Width 72.5 μ; length 130.0 μ. PL. 325, F. 14.—Swamp near Falmouth.

This very common and widely distributed species has been adequately figured by Smith (26), Pl. 56, f. 2, except that the rather coarsely punctated character of the wall, an outstanding feature of the plant, is not shown. Other figures in American literature do not show the three large tubercles across the base of the semicell, the two just above the central tubercle with the mucilage pore between them, and the punctate wall.

EUASTRUM EVOLUTUM (Nordst.) W. and G. S. West var. GLAZIOVII (Boerg.) W. and G. S. West, Jour. Linn. Soc. London, Botany **33**: 292. (*E. Glaziovii* Boerg. G. M. Smith, Wis. Geol. Nat. Hist. Surv. Bull. **57**, Part II: 24, Pl. 56, f. 6).—Width 42.8 μ; length 68.5 μ; isthmus 11.0 μ. PL. 325, F. 21.—Swamp near Falmouth. Previously reported from Wisconsin.

Our specimens are slightly larger than recorded by Smith (26) for Wisconsin forms. Also there is a slight variation in the arrangement of the granules in face view. In the New England plants there is a pair of granules within the apical margin on either side of the median notch and one at either side of the apex of the median notch. This plant certainly seems to be related to *E. evolutum*, especially when regarded in relation to integrading forms and the Wests had good reason for reducing *Glaziovii* to a variety of *evolutum*.

EUASTRUM HUMEROSUM Ralfs. West and West, British Desmidiaceae II: 8, Pl. 34, f. 1, 2.—Width 68.0 μ; length 114.0 μ; isthmus 16.0 μ. PL. 325, F. 2, 3; 11, 12.—Pond near Hyannis.

This large and elegant species shows considerable variation. In this locality the most conspicuous difference is in the depth and narrowness of the upper lateral incisions with the upper lateral lobes directed at a sharper angle than in the typical form. Also in the variant of the Cape Cod region the apical lobe is distinctly anvil-shaped (PL. 325, F. 11) as in *E. pinnatum* and *E. tuddalense*. *E.*

humerosum in Sweden as figured by Borge has an apical lobe with parallel sides, presenting an entirely different aspect from the forms that are found on the Atlantic coastal plain and in Washington where the plant has been recorded by Moore and Moore (24). In New England this form has been previously reported by Harvey from Maine (18). Described as rare in Great Britain *E. humerosum* is widely distributed in the United States, although found but a few times. It is to be noted that all records at present indicate it to be a north temperate form, with habitats in northern Europe, the northern part of the United States and Canada, west to Washington. It has, however, been found in India (W. and G. S. West) and forma *scrobiculata* is reported from Florida (Borge) and Michigan (Prescott and Magnotta).

EUASTRUM INFORME (Borge) Emend. Borge, Arkiv. f. Bot. **19**: 23, Taf. 1, f. 9, 10.

This curiously-shaped species was described by Borge from Brazil. Its appearance in Massachusetts swamps is of particular interest as it has been reported from no other locality. Since Borge was unable to obtain an empty cell for complete description I take the liberty of emending his diagnosis. He states (l. c.) "Leider sind Diagnose und Figuren ein wenig unvollständig, weil ich keine leeren Zellen gesehen habe und also das Ausverhältnismassig grosse, abgerundete Endlappen gibt aber dem Pflanzchen ein von übrigen *Euastrum*-Arten so abweichendes Aussehen, dass ich es für richtig halte, die Form als neue Art aufsustellen."

Semicells with a large median, frequently bisected, tuberculation just above the isthmus, with a slightly smaller tuberculation on the face of each basal lobe; two small tubercles on the face of the apical lobe, one on either side within the apical margin; a large granule on either side of the median notch of the apical lobe; a small, blunt spine on the wall within the lateral incision of the semicell and a blunt spine about half way on the margin of the apical lobe; a blunt spine at the lower angle of the basal lobe; semicell in side view elongate-pyramidate with a distinct incision between the lower and apical portions, lower half of the semicell with a large truncate tuberculation on each lateral margin; upper half of semicell with a small tuberculation on either side and with a smaller granule on the wall about half way between the tuberculation and the blunt, conical protuberance at the apex; in vertical view elliptic, with broadly rounded poles furnished with a blunt spine and with a similar, smaller spine on either side of the poles; three prominent tubercles on the lateral margins. Length 41.8 μ; width 19.0 μ; isthmus 3.8 μ. PL. 00, F. 15–17.—Swamp near Hyannis.

EUASTRUM INSIGNE Hass. West and West, British Desmidiaceae

II: 31, Pl. XXXVII, f. 2–5; Grönblad, Fauna et Flora Fenn. **49**: 17, Pl. 3, f. 35.—Width 56.7 μ; length 105.6 μ. PL. 325, F. 9, 10.—Elizabeth Islands; swamps near Hyannis.

This species is quite incorrectly figured by Wolle and since Wests give only an end view in their North American algae papers it is illustrated for a record from Massachusetts. The plant as it appears in my collections is identical with a form of Grönblad (l. c.) except that his plant is much larger (64.0 μ x 144.0 μ). In side view the specimens show a broader base of the semicell than figured by Wests, with distinct shoulders on the lateral margins at the base of a long neck.

EUASTRUM OBLONGUM (Grev.) Ralfs var. CEPHALOPHORUM West. West and West, British Desmidiaceae II: 14, Pl. 35, f. 1.—Width 73.0 μ; length 151.0 μ. Zygospore 91.0 μ in diameter. PL. 325, F. 1.

Only one specimen of this plant was seen, an empty semicell with a zygospore. It agrees in the essential characteristics with Wests' description of the variety (l. c.) but it is to be noted that the apical lobe of the Massachusetts plant is more like their figure of the typical form than the variety *cephalophorum*. The cell is somewhat smaller than given by Wests (90.0 μ x 155.0 μ). In this country it has been previously reported only from Michigan by Nichols and Ackley (25).

EUASTRUM PINGUE Elfv. West and West, British Desmidiaceae II: 30, Pl. 37, f. 1.—Width 39.0 μ; length 57.0 μ; isthmus 9.5 μ. PL. 325, F. 18, 19.—Pond near Chatham. Previously reported from Me., N. J., and N. Y. (Also recorded for Newfoundland in Mss. of W. R. Taylor 27).

Except for Wolle's insufficient figures this seldom seen species has not been illustrated in American literature. The very large and eccentric pores (one showing in the face of each semicell) are distinctive of this plant.

EUASTRUM PULCHELLUM de Breb. var. RETUSUM West and West, British Desmidiaceae II: 47, Pl. LXIV, f. 17.—Width 24.0 μ; length 36.0 μ; isthmus 4.5 μ. PL. 325, F. 13.—Swamps near Woods Hole; Elizabeth Islands.

Reported as rare in the British Isles, this species is fairly common and widely distributed in North America, having been reported from Mich., Conn., Miss., Wis., N. Y., and Canada.

In forms that the writer has seen from New England there appears to be considerable variation in the number and arrangement of granules as seen in front view. A common expression (figured herein) is one which has certain characteristics of var. *retusum* W. and G. S.

West but shows others that relate it to var. *subabruptum* Grönbl. This is particularly true for the three granules in oblique series on either side of the apical notch. The question arises as to the validity of these varieties in the light of intergrading expressions. Certainly *E. pulchellum* v. *retusum* as described by Wests seems a good variety. The figure of this variety in the manuscript of W. R. Taylor (27) however, shows a combination of characteristics of the typical form, var. *retusum* and var. *subabruptum*. The lateral spines below the apex of Taylor's specimen, if constant, are not typical for this variety, while the apical lobe, sharply set off from the basal lobes, is a character that belongs to the typical form and not to var. *retusum*. The linear arrangement of granules in Taylor's figure indicate the variation in disposition of these bodies. The figure of Hylander's (20) is not quite adequate to separate the plant from its varieties. The figure of G. M. Smith, Roosevelt Wild Life Bull. 2, Pl. 14, f. 2, appears to the writer to be not typical of this species. Certainly the emarginations of the lateral lobes are unusual and the relatively greater length of the cell gives a different aspect to his specimen.

EUASTRUM SINUOSUM Lenorm. var. REDUCTUM West and West, Jour. Linn. Soc. London, Bot. **33**: 83; British Desmidiaceae II: 22, Pl. XXXVI, f. 2, 3.—Width 38.0 μ; length 60.0 μ; isthmus 10.5 μ; thickness 27.0 μ. PL. 325, F. 4.—Elizabeth Islands.

This plant has been reported previously from New England but has not been adequately figured in American literature. The figure of Hylander (20), who has the only New England record, does not show the definitely arranged mucous pores. In the specimens observed by the writer there is a pore in each of the five protuberances as seen in face view, as well as one showing in each of the protuberances on the lateral margins of the cell. In addition to these there is a straight row of four pores extending from the apex of the polar notch to the isthmus and a row of three just within the lateral margins as well as one on either side of the isthmus and just within the basal margin. The arrangement of the pores (exclusive of those in the protuberances) roughly describes a circle, with two pores arranged one above the other along a line bisecting the circle. Taylor in his manuscript (27) illustrates a form similar to the Massachusetts expression of this variety but the pores are arranged differently and there are none, apparently, in the protuberances.

EUASTRUM VALIDUM West and West, Trans. Linn. Soc. London, Botany **5**: 245, Pl. 14, f. 32, 33; British Desmidiaceae II: 75, Pl. XL, f. 21, 22.—Width 19.5 μ; length 27.0 μ; isthmus 4.5 μ. PL. 325, F. 20.

This small and rather plain species apparently has not been reported from this country since 1896 when it was described by the Wests. Taylor (27) has found it in Newfoundland and figures it in a forthcoming paper. The habitat in America is not given by Wests (l. c.) so that this is the first definite record for Massachusetts. It is noteworthy that the New England forms have the prominent median tubercle at the base of the semicell and just above the isthmus, a feature that is apparently absent in the Newfoundland specimens. The lack of this tubercle together with the absence of a central mucilage pore suggest that the Newfoundland plant figured by Taylor (27) is a variety of *E. validum*.

EUASTRUM WOLLEI Lag., Öf. af Kongl. Vetensk.-Akad. Förhandl. **42**, No. 7: 233, Pl. 27, f. 6.—Width 101.7 μ; length 155.0 μ; isthmus 22.6 μ. PL. 325, F. 7, 8.—Elizabeth Islands; pond near Chatham.

This very handsome species has been reported previously from New England by Cushman (9) who found it in N. H., but not figured. The var. *quadrigibberum* was reported by Lagerheim (23) from Tewksbury, Mass. Since published figures in American literature do not seem adequate to the writer the plant is figured herein. Rarely met with in the United States it was first described from New Jersey by Wolle as *E. intermedium* but renamed *Wollei* by Lagerheim (l. c.).

Besides the localities already mentioned it is reported by Taylor (27) from Newfoundland and by Brown (3) from Alabama. Brown's figures (Pl. 13, f. 31, 32) are very interesting but difficult to understand because of what appear to be inconsistencies. Her front view of the cell shows a lateral protuberance on either side and below the apical angles which is not typical of this species. However, in the side view of supposedly the same plant these protuberances are lacking, or, if represented, they appear as two of the apical angles, a correct view of the plant. This species has four distinct apical angles or lobules at the apex of the polar lobe, only two being visible in face view. Brown's figure 31 appears very much as this plant does when seen at an angle from vertical. It is difficult to correlate this possible view with the fact that both poles of the cell show this arrangement of the apical angles and it would be impossible of course to see the two ends of the cell at such an angle at one time. In Brown's description of the plant and in her figures and in the figure of Lagerheim the wall is described and interpreted as being granular. In all plants that the writer has seen the wall is distinctly not granulated. It is, however, very much thickened at the apices of the lobes and is deeply pitted.

The pits give a roughened appearance to the margin of the wall at the angles and show in concentric series on the tumors in front view. It is possible that there is a granular-walled variety of this species.

Additional species of *Euastrum* recorded for Massachusetts are as follows:

EUASTRUM ABRUPTUM Nordst.
EUASTRUM AFFINE Ralfs.
EUASTRUM ANSATUM Ralfs.
EUASTRUM BINALE (Turp.) Ralfs.
EUASTRUM BINALE f. MINOR West
EUASTRUM COMPACTUM Wolle var. MAJOR Lag.
EUASTRUM CRASSICOLLE Lund.
EUASTRUM ELEGANS (de Breb.) Kuetz.
EUASTRUM EVERETTENSE Wolle
EUASTRUM FISSUM W. and G. S. West.
EUASTRUM GEMMATUM de Breb.
EUASTRUM INERME (Ralfs) Lund.
EUASTRUM INTEGRUM Wolle
EUASTRUM MAGNIFICUM Wolle
EUASTRUM OCCIDENTALE W. and G. S. West.
EUASTRUM PINNATUM Ralfs.
EUASTRUM VENTRICOSUM Lund.
EUASTRUM VERRUCOSUM (Ehr.) Ralfs.
EUASTRUM VERRUCOSUM var. ALATUM (Ehr.) Wolle.

Cole (Smith. Contrib. to Knowledge 2, Article 8, 1851) reported four species but his determinations are not acceptable. These are *E. rota*, *E. margaritiferum*, *E. pecten*, and *E. crux-melitensis*.

ALBION COLLEGE,
Albion, Michigan.

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EXPLANATION OF PLATE 325

FIG. 1. EUASTRUM OBLONGUM (Grev.) Ralfs var. CEPHALOPHORUM West (× 246). FIGS. 2–3. EUASTRUM HUMEROSUM Ralfs (× 409). FIGS. 4–6. EUASTRUM SINUOSUM Lenorm. var. REDUCTUM West (× 573). FIGS. 7–8. EUASTRUM WOLLEI Lag. (× 352). FIGS. 9–10. EUASTRUM INSIGNE Hass. (× 463). FIGS. 11–12. EUASTRUM HUMEROSUM Ralfs. Forma (× 409). FIG. 13. EUASTRUM PULCHELLUM Breb. var. RETUSUM West and West (× 594). FIG. 14. EUASTRUM DIDELTA (Turp.) Ralfs (× 315). FIGS. 15–17. EUASTRUM INFORME (Borge) Emend. (× 778). FIGS. 18–19. EUASTRUM PINGUE Elfv. (× 704). FIG. 20. EUASTRUM VALIDUM West and West (× 737). FIG. 21. EUASTRUM EVOLUTUM (Nordst.) West and West var. GLAZIOVII (Boerg.) West and West (× 352).